

Measuring Market Integration in the Global Economy

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Abstract

Measuring the Degree of Market Integration in the Processed Food Industry

The increased level of market integration in the processed food industry through trade, foreign direct investment, and the expanded use of intellectual property rights are an observed phenomenon of the past three decades. Measurement of market integration is problematic, and the role of FDI in market integration has not been adequately taken into consideration. This study measures the growth in the market shares of multinationals in selected countries and industries to indicate the degree of market integration. We also employ a market share convergence type model to estimate whether the market shares of the multinationals and domestically owned firms in key markets have converged to some steady state during the years 1991 to 2003.

Key words: Processed food industry, global integration, market shares, Argentina, Brazil, U.S.

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Measuring Market Integration in the Global Economy

An observed phenomenon of the past three decades is the increased level of market integration in the processed food industry through trade, foreign direct investment (FDI), and the expanded use of intellectual property rights. From the United States alone, agricultural exports grew from under \$10 billion to over \$60 billion in its record year of 1996. Sales from U.S. FDI in processed food alone grew from less than \$20 billion to more than \$130 billion. U.S. agricultural imports grew also, as did FDI into the United States. NAFTA alone brought about a remarkable amount of market integration between the United States and its partners Mexico and Canada.

While this phenomenon clearly has been observed, measuring the degree of market integration is problematic. Increasing market integration has been analyzed through the lenses of commodity prices, stock market, exchange rate, and other financial markets, mostly on an economy wide basis. It appears that foreign direct investment by multinationals in specific industries has not been looked at nearly as much as an indicator of increasing market integration. Given the problematic nature of any measure of market integration, it would be useful to analyze how the flow of foreign direct investment has contributed to the increasing market integration in food processing.

There is considerable literature on vertical and horizontal integration in domestic agriculture. Several methods of measuring integration have been proposed to investigate integration across countries. Across borders, Vollrath and Jinkins (2003) defined market integration in commodity

markets between NAFTA countries through price transmission. But price transmission is not always a measure of increased market integration and may be the outcome of many things. There are many cases that empirically appear to show perfect price transmission when they are really anomalies, and may not necessarily represent market integration at all. In the trade arena, the degree of market integration is measured by the degree of complementarity in bilateral trade using the Drysdale complementarity index (Vollrath, 2001). While the Drysdale measure shows complementarity in trade, it totally ignores the degree of market integration that has occurred because of foreign direct investment (FDI). Markusen in his seminal work on FDI defined integration within industries on the basis of horizontal integration and how this market structure leads to FDI (1998), and others give examples of industries with considerable vertical integration (Hanson, Mataloni, and Slaughter, 2003).

The point of this paper is to demonstrate that market integration has also occurred through FDI. The growth of market shares of multinationals in key markets has significantly contributed to market integration, particularly in markets that are not necessarily reached through international trade. Market integration can and does occur within the confines of multinational companies as these companies seek out new markets and attempt to minimize costs. Many agricultural product markets, such as the grain milling and oilseed processing industries, are characterized by the presence of several multinational companies that compete at some level amongst themselves.

The hypotheses of this study are that market shares of multinationals in certain countries indeed increased during 1991 to 2003, and that the market integration due to FDI occurred differently among host countries and among products. It is also hypothesized that some industries could

have reached a steady state where market shares of the multinationals have reached some stable level. In many cases during 1991 to 2003, multinationals were not the dominant companies in their respective industries in host countries. But their market shares increased because they had lower marginal costs than the domestic companies in those markets, which would be consistent with the Gaskins model. Gaskins (1971) developed an optimal control model that shows that when a dominant firm supports its product price at a noncompetitive level, it leaves room for fringe companies, whose marginal costs are lower, to prosper and gain market share over time eventually eroding the position of the dominant company. The Brazilian and Argentine oilseed processing industries illustrate how multinationals have changed the face of their industries as their market shares increased from a small portion of the national market to a much larger one, eroding the market power of the preexisting firms. From 1991 to 2003, the market shares of foreign multinationals in the Brazilian oilseed processing industry went from 11 percent to over half of processing capacity, and in Argentina their market share went from 16 to 40 percent (see figures in appendix). Brazil and Argentina's wheat flour milling industries illustrated a similar pattern, although the degree was not as marked as for oilseed processing. Likewise, in the Canadian and UK flour milling industries, multinationals' shares went from 10 percent to 71 percent, and from zero to 23 percent, respectively, in just a decade. (Annual growth rates are given in table 1). Multinationals' share of the U.S. flour milling industry reached 66 percent in 2003, albeit that nearly all of the multinationals are U.S.-based (foreign ownership of U.S. wheat flourmills is relatively small). Multinationals also play a large role in the U.S. soybean processing and wet corn-milling industries. The purchases of Cerestar facilities by Cargill marked a decline in the market share of foreign multinationals in the wet corn milling industry, although Tate & Lyle through A.E. Staley holds about 15 percent of the U.S. wet corn milling

industry. Likewise, the market share of foreign multinationals in the U.S. oilseed industry has declined in recent years in an industry dominated by multinationals. Ownership among multinationals has also shifted during the decade. For example, Unilever's Gessy Lever had a leading role in the Brazilian oilseed industry in the early 1990s, but ownership of these same mills shifted to Louis Dreyfus in 1996. In the United States, Central Soya, originally a U.S. company, became part of Italy's Feruzzi and then part of France's Cerestar-Beghin-Say, then Cereol, and is now part of Bunge (a multinational based in the United States).

Drawing on past studies of changing market shares in global commodity trade (Bolling, Somwaru, and Kruse), this study attempts to measure how market shares in the domestic supply of certain products in certain countries have shifted since 1990. In the Bolling, Somwaru, and Kruse study of market shares of the United States, Argentina, and Brazil, the likelihood of convergence of market shares to a steady state was measured. In contrast, we investigate the likelihood of market shares of multinationals and domestically owned companies converging to a steady state within a country. Domestic supply is defined as domestic production from national companies, domestic production produced by multinationals in the host country, and imports. (The host country may also be an export platform.) In this scheme, larger market shares from FDI and trade in the host country would be an indicator of increased integration into the global economy. The host countries chosen for this study are the United States, Canada, Mexico, Brazil, Argentina and the UK. The products chosen are wheat flour and soybean products. (The list of countries and products has temporarily been truncated.) It is interesting to observe how integrated some notable developing countries with macroeconomic policies quite different from the United States, such as Argentina and Brazil, have become, despite lack of closely linked financial markets. In contrast, it is interesting to look at the UK and Canada, the developed

economies most closely integrated to the U.S. economy in both goods trade and financial markets.

Two questions are being answered: (1) Has there been increased market integration as measured by the increased share of multinationals in the processing capacities of the selected country/product markets? (2) Does there appear to be some convergence to some constant level of market share between multinationals and domestic companies in these country/product markets?

Data Sources

The key to success of this study is obtaining data that cover a long time series. Market share data is most often obtained as anecdotal material from news stories. A few data points have also appeared in USDA publications, such as ERS *Sugar and Sweetener Outlook* reports. A few sources provide lists of companies with capacity data on an annual basis. For this study we were able to obtain detailed information on companies from the yearbooks of J.J. Hinrichsen, an Argentine grain and oilseed trading company and *Milling and Baking News*, a U.S. trade magazine. From this detailed data, we calculated market shares of companies that were domestically owned and companies owned by multinationals by year.

Empirical Results

In this section, we analyze the growth patterns of production of domestically owned companies, production of multinational companies in the host country, and imports to the host country, looking at each country and product separately. Secondly, the Argentine and Brazilian wheat milling industry and then the Argentine and Brazilian oilseed processing industry are combined

across countries. (We omit the Canadian and UK wheat milling industries to have consistencies among countries across the industries.) We first estimate the growth rates of market shares of multinationals in each of the country/product markets. From the growth rates of market shares of multinationals, the growth in market shares was fastest in Canadian and Brazilian wheat flour milling, with statistically significant results (table 1). The low statistical significance of the Argentine wheat flour equation is attributable to the fact that the growth in the market share of multinationals was relatively flat.

Table 1—Growth rates of multinational market shares, 1991-2003

Market share of multinationals	Annual growth rate in market share	Standard error of dependent variable	
Brazil oilseed processing	6.1 percent	.244	$R^2 = .889$
Argentina oilseed processing	7.2 percent	.111	$R^2 = .875$
Canada wheat flour milling	22.4 percent	.510	$R^2 = .733$
UK wheat flour milling	9.6 percent	.225	$R^2 = .750$
Brazil wheat flour milling	11.3 percent	.291	$R^2 = .714$
Argentina wheat flour milling	1.3 percent	.077	$R^2 = .273$

Source: Obtained from semi log estimations of the data. Please note that annual growth rates for UK and Canada wheat flour milling do not portray the true growth rates because the increase in market shares was a very large stepwise increase.

Secondly, we empirically estimated the growth pattern, the speed of convergence, and the stability of the market integration pattern following the Barro and Sala-I-Martin example (1996) to establish if indeed there is some convergence to some steady state of market shares. We assess this possibility by estimating the following growth equation:

$$\text{Log}(s_{it} / s_{i, t-1}) = \alpha - (1 - e^{-\beta}) * \log(s_{i, t-1}) + \mu \quad (1)$$

where s_{it} are the market shares of each of the categories of domestic supply, the subscript i denotes the country, the subscript t denotes the year, where μ is the random disturbance. Using the market shares by value of the product, we estimate equation (1).

Table 2—Estimation results of the multinational/domestic company market shares model

Years and country/product combination	Intercept α	Convergence β	Convergence σ	Number of observations
1991-2003				
Oilseed processing industries				
Argentina/Brazil oilseeds	-0.040	0.117** (t = 1.697)	0.166	N = 24
Brazil oilseeds	-0.006	0.123 (t = 0.1072)	0.232	N = 12
Argentina oilseeds	-0.219	0.257** (t = 1.64)	0.133	N = 12
Wheat milling industries				
Argentina/ Brazil wheat milling	-0.129	0.104** (t = 1.666)	0.212	
Brazil wheat milling	-0.393	0.223 (t = 1.21)	0.291	N = 12
Argentina wheat milling	-0.488	0.495 (t = 1.52)**	0.075	N = 12
UK wheat milling	-0.209	0.153 (t = .833)	0.243	N = 12
Canada wheat milling	-0.024	0.208 (t=1.11)	0.497	N = 12

Source: empirical model results from equation (1).

Initially, we chose exporting countries so that the convergence is between production from domestically-owned firms and foreign-owned firms. Each country/product combination was run as a separate regression. Secondly, Argentine and Brazilian oilseed processing and Argentine and Brazilian wheat flour milling data were pooled together to determine whether indeed there was some common convergence of multinational market shares in their common industries.

The estimated β 's of convergence are interpreted as the slope of the rate of convergence of the market shares of multinationals and domestically owned firms of the industry. The estimated β 's

of convergence for the entire period are positive, implying that the multinational/domestic company market shares are converging. The speed of adjustment between multinational ownership and domestic ownership in Argentine oilseed processing, Argentine wheat milling, and UK and Brazilian wheat milling appeared to occur quite rapidly from 1991 to 2003. The most statistically significant β of convergence is for Argentine oilseeds and wheat. In many cases, the convergence has been step-wise as major companies purchased several processing facilities at a time. The UK wheat milling industry is an example where virtually all of the wheat milling was domestically owned until a U.S. multinational several large flour mills in the late 1990s and in 2003.

Combinations of Argentina and Brazil oilseed processing and wheat flour milling were also tested as to whether there was common convergence in multinationals' market shares across groups of countries. The convergence across the Argentine and Brazilian wheat flour industry was significant at the 10 percent level of significance, and there was convergence across the Argentine and Brazilian oilseed processing industry but it was not significant, as measured by the t-test. According to the cross-sectional Chow tests, the calculated $F(1,22)$ of 3.176 indicates that the Brazilian oilseed processing industry equation is significantly different from the Argentine oilseed processing industry equation (The critical value is 4.75 at the 95th percentile of the F distribution). In comparison, the calculated $F(1,22)$ of 1.066 indicates that the Brazilian wheat flour milling industry equation is significantly different from the Argentine wheat flour milling industry equation.

The estimated σ of convergence, measured by the variance of the regression, captures the dispersion of the process or the degree of uneven growth. The Argentine wheat milling and

oilseed industries experienced the least dispersion. The most dispersion occurred when growth occurred in a stepwise manner, especially in the Brazil, Canadian, and UK wheat milling industries. The wide dispersion indicates that the transition from domestic companies to multinationals occurred in some uneven way, most often from large purchases and divestitures in a single year.

In conclusion, the study indeed established that there was considerable growth in the market shares of multinationals in the industries of the host countries that we investigated, and that the measurement was statistically sound. The statistical results led to the conclusion that market integration indeed occurred through FDI in addition to trade liberalization. By further investigation, we established that the paths have differed among countries and industries. There are a few host countries where the market shares of multinationals appear to have stabilized. In other host countries, the market share of multinationals continues to increase, and has not stabilized at all. The positive sign on the β of convergence indicates that there has been some convergence in the rate of growth in every case. While there has been some convergence in the rate of growth in every case, convergence appears to have been uneven.

During 1991 – 2003, the Argentine wheat milling and oilseed industries appeared to be reaching some steady state in market shares. In contrast, the Brazilian oilseed processing industry did not reach a steady state of market share between multinationals and domestically owned firms. Because of the differences in Argentina's and Brazil's behavior in this small sample, the equations with pooled data when compared to equations from single country data show that the rate of convergence is not the same across countries.

Further research would provide more significant evidence of the universal growth of market shares of multinationals throughout the global food industry. With much more data, it would be feasible to test whether market integration is universally occurring through FDI. Although research is constrained by the availability of data for a wider range of country/product combinations and for a longer time period, testing of more country/industry combinations would substantiate the findings of this study. There are also questions beyond this study as to whether market structure defines whether multinationals are the best purveyors of market integration, or whether increased market power allows multinationals to gain product-pricing advantages at a noncompetitive level. This paper also does not address the fact that market integration can also occur among companies that are not necessarily large multinational firms. Questions relating to the role of contestability in market integration could also be addressed.

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